

CLAIMS

WE CLAIM:

1. A method of fabricating a MEMS structure, comprising the steps of:
 - (a) forming a recess in an upper surface of a substrate;
 - (b) attaching an etchable wafer to the upper surface of the substrate, including a wafer portion from which a movable structure will be formed, the wafer portion being positioned over the recessed; and
 - (c) etching downward in the wafer around the periphery of the movable portion to break through in to the recess, thereby releasing at least part of the movable structure from the substrate without the need for substantial undercutting.
2. The method as recited in claim 1, further comprising depositing a conductive layer onto the wafer.
3. The method as recited in claim 2, further comprising depositing a protective layer onto an upper surface of the conductive layer.
4. The method as recited in claim 2, wherein the conductive layer is selected from the group consisting of aluminum, copper, silver, gold and nickel.
5. The method as recited in claim 3, wherein the protective layer is selected from the group consisting of silicon dioxide and silicon nitride.
6. The method as recited in claim 1, wherein the wafer is selected from the group consisting of silicon, silicon carbide and gallium arsenide.
7. The method as recited in claim 1, wherein the substrate is a non-conductive substrate selected from the group consisting of glass, high resistivity silicon, crystalline sapphire, and ceramic.
8. The method as recited in claim 1, wherein the substrate is a conductive substrate selected from the group consisting of silicon, silicon carbide, and gallium arsenide.

9. The method as recited in claim 1, wherein the recess has beveled edges.
10. A MEMS structure comprising:
a substrate having a recess disposed in the upper surface thereof;
at least one conductive element that is attached to the substrate and that extends outwardly therefrom;
a movable MEMS element disposed adjacent the at least one conductive element forming a variable size gap therebetween, wherein the movable MEMS element is free from the substrate and in at least partial alignment with the recess.
11. The MEMS structure as recited in claim 10, wherein the cavity is etched into the substrate.
12. The MEMS structure as recited in claim 10, wherein the substrate is a non-conductive substrate selected from the group consisting of glass, high resistivity silicon, crystalline sapphire, and ceramic.
13. The MEMS structure as recited in claim 10, wherein the substrate is a conductive substrate selected from the group consisting of silicon, silicon carbide, and gallium arsenide.
14. The MEMS structure as recited in claim 10, wherein the at least one conductive element is selected from the group consisting of silicon, silicon carbide, and gallium arsenide.
15. The MEMS structure as recited in claim 10, further comprising a layer of conductor that is disposed on an upper surface of the at least one conductive element.
16. The MEMS structure as recited in claim 15, wherein the layer of conductor is selected from the group consisting of aluminum, copper, silver, gold, nickel, and highly doped semiconductor materials.
17. The MEMS structure as recited in claim 16, further comprising a protective layer that is disposed on top of the layer of aluminum.

18. The MEMS structure as recited in claim 17, wherein the protective layer is selected from the group consisting of silicon dioxide or silicon nitride.

19. The MEMS structure as recited in claim 10, further comprising an intermediate layer that is disposed between the at least one conductive element and the substrate.

20. The MEMS structure as recited in claim 19, wherein the intermediate layer is selected from the group consisting of silicon dioxide and silicon nitride.

21. The MEMS structure as recited in claim 10, wherein selectively etching the intermediate layer releases the movable MEMS element from the substrate.

22. The MEMS structure as recited in claim 10, wherein the movable MEMS element is selected from the group consisting of silicon, poly-crystalline silicon, amorphous silicon, silicon carbide and gallium arsenide.

23. The MEMS structure as recited in claim 10, further comprising a base layer that forms a lower surface of the movable MEMS element.

24. The MEMS structure as recited in claim 23, wherein the base layer is nonconductive.

25. The MEMS structure as recited in claim 24, wherein the base layer is selected from the group consisting of silicon dioxide or silicon nitride.

26. The MEMS structure as recited in claim 10, wherein the recess has beveled outer edges.

27. A MEMS structure comprising:
a substrate having a recess disposed in the upper surface thereof;
at least one conductive element that is directly attached to the substrate and that extends outwardly therefrom;

a movable MEMS element disposed adjacent the at least one conductive element forming a variable size gap therebetween, wherein the movable MEMS element is free from the substrate and in at least partial alignment with the recess.

28. The MEMS structure as recited in claim 27, wherein the movable MEMS element further comprises an nonconductive layer disposed adjacent the gap.
29. The MEMS structure as recited in claim 27, wherein the movable MEMS element is at least partially selected from the group consisting of silicon, silicon carbide and gallium arsenide.
30. The MEMS structure as recited in claim 29, wherein the movable MEMS element further comprises a conductive layer disposed thereon.
31. The MEMS structure as recited in claim 30, wherein the conductive layer is selected from the group consisting of aluminum, copper, silver, gold and nickel.
32. A MEMS structure comprising:
a substrate having a recess disposed in the upper surface thereof;
first and second conductive elements that are directly attached to the substrate and that extend outwardly therefrom;
a movable MEMS element disposed adjacent the conductive elements forming a variable size gaps therebetween, wherein the movable MEMS element is free from the substrate and in at least partial alignment with the recess.
33. The MEMS structure as recited in claim 32, wherein the movable MEMS element further comprises a nonconductive layer disposed adjacent the gaps.
34. The MEMS structure as recited in claim 32, wherein the movable MEMS element is at least partially selected from the group consisting of silicon, silicon carbide and gallium arsenide.
35. The MEMS structure as recited in claim 33 wherein the movable MEMS element further comprises a conductive layer
36. The MEMS structure as recited in claim 35, wherein the conductive layer is selected from the group consisting of aluminum, copper, silver, gold and nickel.
37. The MEMS structure as recited in claim 32, wherein the first and second conductive elements are electrically isolated from each other.

38. The MEMS structure as recited in claim 32, wherein the movable MEMS element further comprises at least two conductive elements.

39. The MEMS structure as recited in claim 38, wherein the at least two conductive elements of the MEMS structure are electrically isolated from each other.